II. 5. — The Deflocculation of Kaolin by Tree Leaf Leachates

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A feature often found in soils of the podzolic group is the presence of texture differentiation within the profile. On the one hand this may result in the formation of a clay B horizon, as in the case of the grey wooded, brown forest and grey-brown podzolic soils, and on the other hand in loss of clay from the solum, as is apparently the case in the kauri podzol. In extreme cases the A_2 horizon of a kauri podzol may consist of nearly pure silica (as opposed to quartz), so that here at least, it seems probable that the dominant effect is one of enhanced weathering in the eluvial zone, with little or no re-synthesis of clay at greater depth.

In cases where clay accumulation takes place, it is not known to what extent the « illuvial » clay has been synthesized *in situ*, or washed down from above.

Experiments in progress in this laboratory indicate that physical transportation of clay may result from the action of rain water charged with organic compounds leached from A_0 horizon. It has been found that aqueous leachates of a variety (1) of broadleaved and coniferous leaves have a marked deflocculating effect on kaolin suspensions (1).

After addition of an aspen leaf extract, deflocculation of a kaolin suspension commenced at about pH 4, whereas the untreated suspension remained flocculated until the pH was raised to c. 8.5 (figure 1).

In the majority of cases, as the concentration of plant extract

(1) Aspen, ash, oak, birch, calluna, *Pinus pinaster, P. picea*, Scots pine, Sitka spruce, Norway spruce, larch, kauri (*Agathis australis*), rimu (*Dacrydium cupressinum*), Huon pine (*D. franklinii*), *Eucalyptus regnans, E. marginata.*

Figure 1.

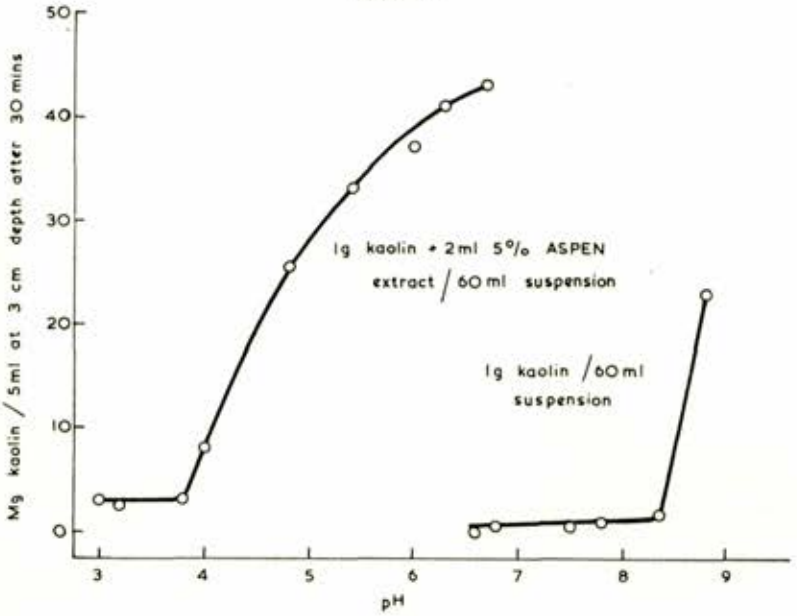
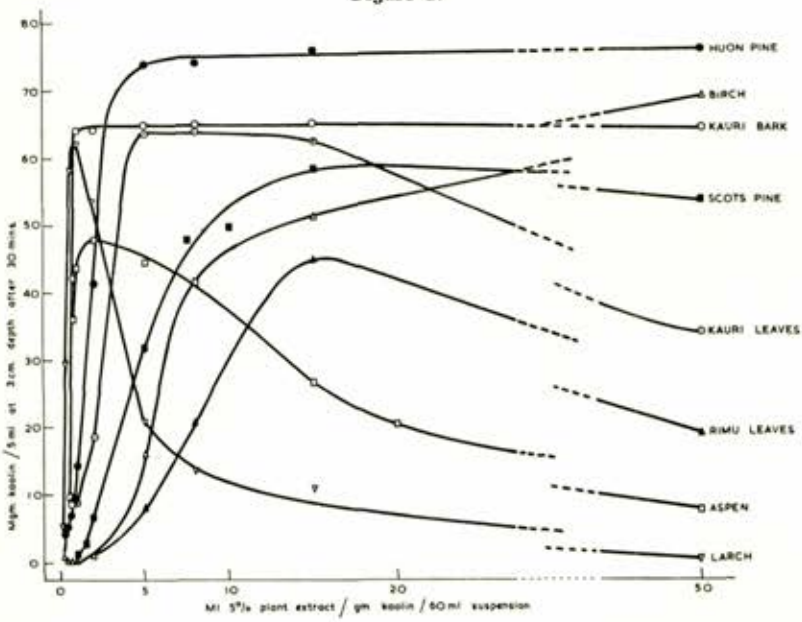


Figure 2.



is increased, the degree of deflocculation rises to a maximum and then decreases. Typical results are illustrated in figure 2, from which it can be seen that reflocculation develops more slowly than the preceding deflocculation.

A problem of considerable importance in connection with the podzolic group as a whole is the relative importance of the movement of iron and aluminium in solution, as opposed to translocation as a sesquioxide coating on clay particles. In this connection the results obtained with kauri and rimu leaves are of interest. Although the kauri is considerably more effective as a podzol former, laboratory experiments have shown that rimu leaf extracts dissolve ferric oxide more readily than do those of kauri leaves (2). It can be seen from figure 2 that kauri leaves are more effective than rimu leaves in causing deflocculation, so that this property of the kauri could be a factor contributing to its greater overall effectiveness as a podzolizing agent.

Dialysis of aspen and ash extracts through cellophane results in the loss of some 40-50 % of the total solids, but has little effect on the deflocculating and reflocculating properties of the solutions. It is apparent therefore that compounds of low molecular weight play little part in the process, at least for these two species.

From the results of preliminary qualitative experiments on montmorillonite suspensions with either ash or aspen extracts, it seems that the same sequence of deflocculation-flocculation is produced by increasing the concentration of plant extract in the suspension, but in this case the systems are complicated by the presence of appreciable amounts of soluble calcium compounds in the extracts. It is therefore not possible at this stage to say how far the reflocculation is caused by the increase in the concentration of calcium.

REFERENCES

1. Bloomfield, C. — Sesquioxide Immobilization and Clay Movement in Podzolized Soils, *Nature*, CLXXII, p. 958 (1953).
2. — A Study of Podzolization : Pt. 3, The Mobilization of Iron and Aluminium by Rimu (*Dacrydium cupressinum*), *Jour. Soil Sci.*, V (1954) (in press).

Summary. — *Texture differentiation which is frequent feature in podzolic soils, may result from the accumulation of clay in the B horizon. Experiments, reported in this paper, indicate*

that physical transportation of clay may result from the action of rain water charged with organic compounds leached from the A_0 horizon. It has been found that aqueous leachates of the leaves of some fifteen species of broadleaved and coniferous trees, at low concentrations, have a marked deflocculating effect on kaolin suspensions. In most cases, as the concentration of plant extract is increased, the extent of deflocculation reaches a maximum and then decreases, more or less abruptly depending on the species. It is pointed out that kauri leaves (Agathis australis) *are more effective than rimu leaves* (Dacrydrium cupressinium) *in causing the deflocculation so that this property of the kauri could be a factor contributing to its greater overall effectiveness as a podzolizing agent. Preliminary experiments on montmorillonite suspensions with plant extracts indicate the same sequence of deflocculation-flocculation by increasing the concentration of the plant extract.*

RÉSUMÉ. — *La différenciation de la texture du profil qu'on observe fréquemment dans les sols du groupe podzolique, peut résulter de l'accumulation de l'argile dans l'horizon B, par suite du transport de l'argile par l'eau de pluie chargée de composés organiques lessivés de l'horizon A_0.*

L'A. rapporte que l'addition des percolats de feuilles d'essences forestières (feuillus et conifères) dans une suspension de kaolin produit la défloculation du kaolin, qui débute dès que la solution accuse un pH 4 environ. Dans la plupart des cas, lorsque la concentration d'extraits végétaux est augmentée, la peptisation atteint rapidement un maximum et décroît ensuite, plus ou moins brusquement, suivant l'espèce végétale.

Des séparations par dialyse ont démontré que ce sont les constituants à poids moléculaire élevé qui prennent la plus large part dans la peptisation du kaolin.

Les essais préliminaires avec les extraits de feuilles du tremble et du frêne dans des suspensions de montmorillonite ont donné des résultats similaires.